PATENT SPECIFICATION

735,538

Date of Application and filing Complete Specification : March 4, 1953. No. 6054/53.

Complete Specification Published : Aug. 24, 1955.

Index at acceptance: Class 81(2), B15C(1A:4).

COMPLETE SPECIFICATION

Improvements in or Relating to Hypodermic Injection Apparatus

I, GERALD OBIL TRANSUE, a Citizen of the United States of America, of 1228 Bon Air Road, Havertown, County of Philadelphia and State of Pennsylvania, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Circumstances frequently occur in which many lay persons use hypodermic injectors either for self administration or for the treatment of members of the family. In the use of such hypodermic injectors, the operation of inserting the needle into the flesh or muscle of the patient constitutes the difficulty or barrier that must be overcome by these lay users of the hypodermic syringe. The present invention aims to provide an improved device designed to receive the syringe and to greatly facilitate the step of embedding or inserting the needle into the body of the patient.

The present invention, therefore, relates generally to hypodermic syringe injector apparatus and more particularly to apparatus designed to receive a conventional hypodermic syringe, the apparatus being operable for the automatic insertion of the injector needle into the body of the patient.

According to the invention the apparatus comprises a support for a hypodermic syringe injector having an injector needle the said support being slidably mounted in a casing structure which comprises two telescopically mounted tubular members and retaining means adapted to hold the said support in a retracted position against the action of resilient means, the arrangement being that relative axial movement of the said tubular members is effective to disengage the said retaining means so as to release the support for projection by the resilient means and consequently carry with it the hypodermic syringe and bring the said needle to a projected position. If, therefore, the apparatus with the syringe injector retracted, is disposed adjacent to the area to be injected, the injector needle will be automatically inserted in the said area when the retaining means is released and the syringe injector is projected. Means may be provided whereby the depth of insertion of the into the body of the patient can be automatically controlled or pre-determined.

In order that the invention may be clearly understood and readily carried into effect, one construction for apparatus according to the invention will now be more fully described, by way of example only, with reference to the accompanying drawings, in which:—

Fig. 1 is a side elevational view, partly in section, showing apparatus constructed according to the present invention in its normal, uncocked condition;

Fig. 2 is a longitudinal sectional view of the apparatus in its intermediate condition or in the process of being cocked;

Fig. 3 is a view similar to Fig. 2 showing the apparatus fully cocked;

Fig. 4 is an enlarged view of the detail enclosed within the dot-and-dash circle of Fig. 2;

Fig. 5 is an enlarged detail of the portion enclosed within the dot-and-dash circle of Fig. 3;

Fig. 6 is a similar detail of the portion enclosed within the dot-and-dash circle of Fig. 1; and

Fig. 7 is a sectional view taken along line 7—7 of Fig. 2.

Referring to the drawings, the particular construction illustrated includes a hollow casing 10 which is designed to receive

a conventional hypodermic injector 11 and hold the same therein in locked position with its plunger 12 protruding from the casing so as to permit of the injection of the fluid into the body by the usual manipulation of the plunger. The casing 10 consists of several telescopically interfitting and intervengaging parts which preferably encase substantially all of the syringe 11 except for the protruding end portion of the plunger 12. The injection needle 13 is adapted to project from the open end of the housing or casing 10 and is thus available for insertion into the body of the patient when the casing is manipulated and operated as hereinafter described.

The conventional hypodermic syringe 11 usually comprises a syringe barrel 14, which receives the therapeutic fluid, and a rod-like plunger 12 for expelling the fluid from the barrel. At one end the syringe barrel is provided with an internal collar or flange 15 and at its ejection end it is provided with a discharge tip which mounts the hub 16 of hollow needle 13.

In accordance with the present invention, the housing casing 10 for the syringe consists essentially of three open-ended cylinders 17, 18 and 19, preferably but not necessarily formed of metal. The inner cylinder 17 is of an internal diameter somewhat greater than the diameter of the syringe barrel 14 so that the entire hypodermic syringe may be inserted and removed from the cylinder with facility. This cylinder 17 is provided with an enlarged head 30 having an interiorally screw-threaded recess 31 so that when the syringe is inserted into the cylinder 17 the flange 15 of the syringe will abut against the bottom of the recess 31. A rear closure member 28 is provided having a threaded plug portion 20 which enters the recess 31, and a central body portion 21 of the cover 28 is provided with a central aperture 22 of a diameter less than that of the flange portion 15 of the syringe barrel but greater than that of the enlarged head of the syringe plunger 12. Thus, the closure member 28 when threaded into the enlarged head 30 of the cylinder 17 secures the syringe barrel in place while permitting the plunger of the syringe to be axially shifted as necessary to fill the syringe with the hypodermic solution and inject it into the patient's body following penetration of the syringe needle.

The wall thickness of the cylinder 17 is reduced along the rear portion 23 thereof, thus providing an annular shoulder constituting a frontal abutment for a helical spring 24 closely embracing the said rear portion 23 of the cylinder 17. The intermediate cylinder 18, which is telescopically fitted upon the cylinder 17, is provided at its rear end with an inturned flange 25 which serves as a rear abutment for the spring 24. The latter thus serves to exert a constant pressure on the cylinder 18 tending to force it axially toward the enlarged head 30 of the inner cylinder 17.

The external cylinder 19 is telescopically fitted upon the forward end of the intermediate cylinder 18, and is provided with a forwardly extending portion having an internal diameter less than the external diameter of the member 18. Thus, the member 19 is provided intermediate its length with an internal annular shoulder 26 which serves as a stop to limit axial movement of the members 18 and 19 inwardly of each other.

The cylinder 19 is provided at its forward end with an adjustable protector sleeve 40 which is threadedly engageable into and out of the free end of the cylinder 19 and may be held in adjusted position by a knurled nut 41, threaded on said protector sleeve 40. This protector sleeve is preferably provided with an oblique face 42 which is designed to be placed directly against the epidermis of the patient and so facilitate insertion of the needle at the appropriate angle.

For the purpose of holding the several cylinders 17, 18 and 19 in permanent assembly, and for the further purpose of providing stops or motion limits for each of the cylinders and to cock the apparatus, the device includes a plurality of circumferentially spaced detent balls 33 which are normally disposed, respectively, within suitable apertures 34 formed in the cylindrical wall of that portion of the intermediate cylinder 18 which is disposed between the cylinders 17 and 19. For this reason this intermediate cylinder 18 may hereinafter be referred to as the ball-carrying cylinder. The diameter of each of the balls 33 is substantially greater than the wall thickness of the ball-carrying cylinder 18, and, therefore, when the apparatus is in its normal position as shown in Fig. 1, the balls 33 protrude from their seats in the cylinder 18 into an annular channel 35 formed on the interior face of the cocking cylinder 19. The combined depth of the channel 35 and the thickness of the ball-carrying cylinder 18 is at least equal to the diameter of the ball 33. It will thus be apparent that in this position the cylinders 17, 18 and 19 are not only freely revolvable relatively to each other but also that the inner cylinder 17 is free to shift axially in the direction of the arrow A shown in Fig. 2 against the compressive force of the spring 24. To limit this axial movement of the cylinder 17, the latter is provided with an annular channel

36 which is not quite of the same depth as the channel 35, this channel 36 being preferably approximately half the depth of the channel 35. When, therefore, the cylinder 17 is drawn against the spring 24 into the position shown in Fig. 2, the balls 33 will enter the channel 36 as shown in Fig. 2 and in enlarged form in Fig. 4. In this position, the device is in an intermediate, uncocked position, for the reason that the detent balls 33 are in position to move radially into the channel 35 so that when released the spring 24 is still able to push the cylinder 17 in the direction of the arrow B back to its position shown in Fig. 1. In order to hold the instrument in its final cocked condition, the interior of the cocking cylinder 19 is provided with an additional communicating channel 37 which is approximately half the depth of the channel 35, it being this channel 37 which receives the balls 33 when the device is in its final cocked position as shown in Figs. 3 and 5.

In use, when it is desired to cock the device of the present invention, it is merely necessary to lightly grip the cocking cylinder 19 between the fingers of one hand and to pull on the head 30 with the other hand in the direction of the arrow A shown in Fig. 2, the syringe parts being supported by the assembly. As a consequence of this operation, the inner cylinder 17 will move from the position shown in Fig. 1 to its position shown in Fig. 2, in which position the spring 24 will be fully compressed as shown. At this point, one or more of the detent balls 33 will drop into the position shown in Fig. 4, thereby preventing further movement of the cylinder 17 in the direction of the arrow A relatively to the cylinder 18. As the force is further applied at this point, the intermediate cylinder 18 will now move in the direction of the arrow A, under the influence of the spring 24 and also on account of the ball or balls 33 engaging in the channel 36, such that all the balls 33 will be forced by the channel 37 to occupy the position shown in Fig. 5, in which position the several balls 33 are so frictionally retained in the channel 37, due to the force of the spring 24 acting on the cylinders 18 and 17 thus tending to urge the balls 33 outwardly against the channel 37, as to hold the cylinders in their relative positions shown in Fig. 3 against the force of the spring 24. In this way a wedging action takes place so that the stronger the force of the spring the more tightly are the balls forced into the channel 37 to resist relative movement of the cylinders.

Having thus cocked the device, it is only necessary to grasp the body of the cylinder 18 and so apply the free face 42 of the protector sleeve 40 against the epidermis of the patient at the point where it is desired to make the injection with sufficient pressure as to cause the cocking cylinder 19 to shift relatively to the cylinder 18 into its position shown in Figs. 2 and 4. Under those circumstances, the spring 24 acting against the cylinder 17 will cause the surface of the channel 36 to function as a cam and thus force the detents 33 outwardly into the channel 35. Thereupon, the spring 24 will exert all its pressure against the cylinder 17 to move the same together with the syringe in the direction of the arrow B in Fig. 1 and so drive the needle 13 into the body of the patient. In this operation the operator should preferably continue to grip the cylinder 18 and through it firmly press the open face of the protector sleeve 40 against the body of the patient.

The user may adjust the position of the protector sleeve 40 prior to the injection. With the device in its normal, uncocked condition, the user adjusts the sleeve 40 to the desired position by observing the length of the needle that projects from the sleeve, for it is this length that will be inserted into the tissues. When the device is in its cocked position the needle will be withdrawn into the protector sleeve 40. After the device is cocked, the user grips the cylinder 18 firmly and presses the face 42 against the body. The needle will then be automatically inserted into the tissues to the desired position by observing the jecting the plunger 12 with respect to barrel 14, the medicament is hypodermically injected through the bore of the needle 13.

It will be understood, of course, that the present invention is susceptible of various changes and modifications which may be made from time to time without departing from the scope of the appended claims.

What I claim is:—

1. Hypodermic syringe injector apparatus comprising a support for a hypodermic syringe injector having an injector needle, the said support being slidably mounted in a casing structure which comprises two telescopically mounted tubular members and retaining means adapted to hold the said support in a retracted position against the action of resilient means, the arrangement being that relative axial movement of the said tubular members is effective to disengage the said retaining means so as to release the support for projection by the resilient means and consequently carry with it the hypodermic syringe and bring the said needle to a projected position.

2. Apparatus according to Claim 1, in

which the said support comprises a cylindrical chamber adapted to receive and hold the syringe injector with its needle projecting from the chamber, the said casing being telescopically fitted to the said chamber.

3. Apparatus according to Claim 1, in which the support comprises a tubular chamber adapted to receive and hold the syringe injector therein with the injector needle protruding therefrom, the said tubular chamber being telescopically mounted in the telescopically mounted tubular members which comprise a detent carrying tube and a cocking tube telescopically mounted on the detent carrying tube and the said resilient means comprises a coiled spring interposed between the tubular chamber and the detent carrying tube and adapted to be compressed by relative movement of the said chamber and tube, the detent carrying tube having one or a plurality of apertures in which or in each of which ball detents are disposed for co-operation with channelled portions of the tubular chamber and of the cocking tube respectively, whereby the ball detents are operative to retain the tubular chamber in retracted or cocked position.

4. Apparatus according to Claim 3, in which the channelled portion of the cocking tube comprises an annular groove of asymmetric form in transverse cross-section substantially in registry with the said aperture or apertures in the detent carrying tube, and providing a pair of intersecting, radially offset annular seatings, the said ball detent or detents being adapted for disposition in one or the other of said annular seatings according as the tubular chamber is displaced to bring either its channelled portion or a plain portion in registry with the said aperture or apertures in the detent carrying tube.

5. Apparatus according to Claim 4, in which the said ball detent or detents are operative, when disposed between the channelled portion of said tubular chamber and the inner one of the radially offset annular seatings, to frictionally retain the chamber in retracted position within the said cocking tube and detent carrying tube.

6. Apparatus according to any one of Claims 2 to 5, in which the said resilient means comprises a coiled compression spring operatively associated with the said chamber and its casing for providing a bias normally tending to move the chamber axially in its casing.

7. Apparatus according to Claim 6, in which the said compression spring is operative upon retraction of the chamber to exert a rearward thrust against one of the telescopically mounted tubular members of the casing to effect engagement of the said retaining means.

8. Apparatus according to Claim 4 or Claim 5 and Claim 6, in which the said compression spring is operative upon retraction of the chamber to exert a rearward thrust against the detent carrying tube to displace the latter relatively to the cocking tube and so effect frictional retention of the ball detent or detents between the inner one of the said radially offset annular seatings and the channelled portion of the chamber.

9. Apparatus according to any one of Claims 2 to 8, in which the outermost of the said telescopically mounted tubular members of the casing has an extension adjustably supported thereon to project forwardly thereof and to enclose the said needle when the syringe is retracted, the said extension serving for moving the said outermost tube relatively to the other tube to disengage the said retaining means.

10. Apparatus according to any one of the preceding claims, including a part adapted to engage with a flange portion of the syringe injector barrel, the said part being formed with an opening through which the plunger of the syringe extends whereby the said plunger can be projected with respect to the barrel to expel medicament from the barrel after the syringe has been projected.

11. An automatic injector for hypodermic needles including in combination an outer, an inner and an intermediate tubular member having parts of their bodies disposed in overlapping relationship, means for retaining said members for limited axial movements with respect to each other, means associated with the innermost of said members for supporting a hypodermic syringe injector having an injector needle, a spring acting against said innermost member and one of the other members for urging the inner member into a projected position relatively to the other members, detent means engaging said innermost member to retain the latter against projection and means connected to said detent means to release the latter upon said intermediate and outer members being moved axially with respect to each other.

12. Apparatus according to Claim 11, in which the said intermediate member constitutes a grasping and manipulating unit for the said needle injector, and the said outer member extends adjacent to the needle of the syringe assembly supported by the said inner member.

13. Apparatus according to Claim 1, having its parts constructed and arranged substantially as described with reference to the accompanying drawings.

For the Applicant,
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
51/52, Chancery Lane, London, W.C.2.

Printed for Her Majesty's Stationery Office by Wickes & Andrews, Ltd., E.C.4. 684/2.—1955.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

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1 SHEET

This drawing is a reproduction of the Original on a reduced scale.